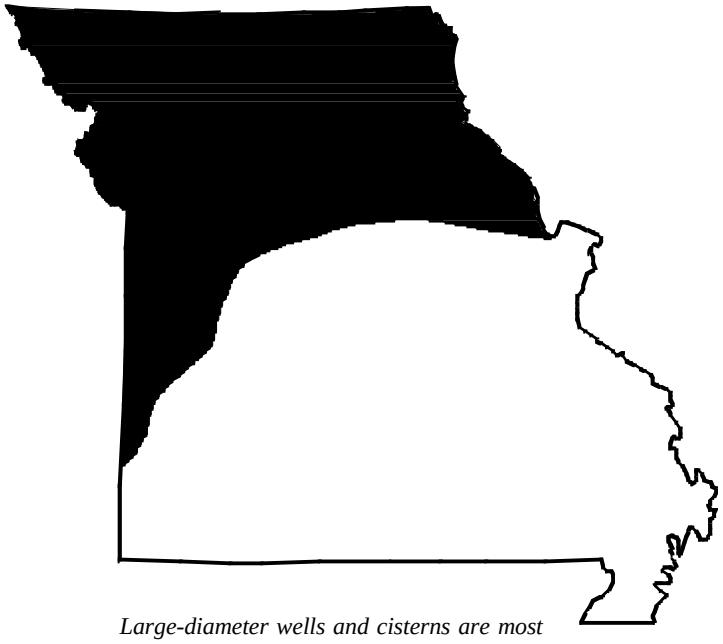
Missouri Department of Natural Resources
"Integrity and excellence in all we do"

Eliminating An Unnecessary Risk: Abandoned Wells and Cisterns

Geological Survey and Resource Assessment Division fact sheet 7/2002

Many things have changed since Missouriís early settlement days more than 150 years ago, but one that has not is the need for a dependable supply of water. Springs and springfed streams draining from thick bedrock aquifers provided water to many of the early settlers in the Ozarks region. But springs are rare in northern and western Missouri, and most streams here cease flowing during dry weather. Even in the Ozarks there are areas devoid of springs and year-round flowing streams, so early residents in these parts of the state had to construct wells and cisterns to supply them water.

The early wells and cisterns constructed in Missouri bear little resemblance to their modern counterparts. Built before drilling machines were invented or commonly available, these early wells and cisterns were dug and constructed by hand with pick and shovel. Their means of construction account for their size; the hole had to be large enough for a person to work in. Most hand-dug wells and cisterns are from three to six feet in diameter. Unlike modern wells, they do not contain casing. Brick or field stones were used to line the well, holding the materials in place while allowing water to enter. Their depths are variable; if ample water was encountered at a shallow depth there was little need to dig deeper. Some bottomed no more than ten feet below land surface, while others are more than 30 feet deep. Though they were dug to produce groundwater, many did not. Instead of abandoning a hole that took weeks to dig and trying again elsewhere, many were finished to use as cisterns. Unlike wells, cisterns do not produce water but simply store it. Runoff from rooftops is caught by gutters and channelled through downspouts to the cistern to supply water between rains. If necessary, water is hauled from other sources to refill cisterns during very dry weather. Locally, dug wells which produced groundwater are referred to as ìliving wellsî while cisterns are often called ìwellsî even though they are only a storage structure.



Large-diameter wells and cisterns are most common in northern and western Missouri. Drilled wells, while most common in the Ozarks region, are found in all parts of the state.

Originally, dug wells and cisterns were a valuable asset to any landowner; a farm with wells was more valuable than one without any water supply. Nearly every northern and western Missouri farmstead had one or more wells or cisterns. Before community water supplies were developed, wells and cisterns also supplied people living in towns. Water supply is as important today as ever, but many things have changed since the days of the hand-dug well. Most rural communities have public water supplies. Rural public water supply districts supply many farms and rural residents, and ponds are widely used for watering livestock. Farms have also increased in size, so there are fewer people and farmsteads to supply. As a result, many of the wells and cisterns that were so important a few decades ago are no longer used or needed. In fact, they are no longer an asset but a serious liability.

PUB000682

PUB000682

DEADLY TRAPS

Abandoned large-diameter dug wells and cisterns are a very real and deadly threat to the residents of rural Missouri. If kept in good repair, they present little threat to human safety, but many well and cistern covers were constructed from wood which can be weakened or destroyed by the elements. Even those with concrete covers are subject to deterioration. In recent years, abandoned wells have received much notoriety in the press when they have claimed the lives of children who have fallen into them and drowned. Many dug wells and cisterns are still in use. When properly maintained they present little risk, but when abandoned they become potential traps and are an unnecessary risk to human life.

There are several types of abandoned wells in Missouri. Abandoned small-diameter drilled wells are found throughout the state and threaten groundwater quality. They can allow contaminants to enter aquifers, but usually do not present a threat to the immediate safety of small children. Large-diameter dug wells and their more modern counterpart, bored wells, present less risk to groundwater quality than drilled wells, but if not properly covered or plugged, can kill. While all types of abandoned wells can cause groundwater contamination, cisterns, being subsurface water-storage ìtanks,î do not present as much of a contamination threat. However, they are just as deadly as dug and bored wells if abandoned and left uncovered or unplugged.

PLUGGING ABANDONED WELLS

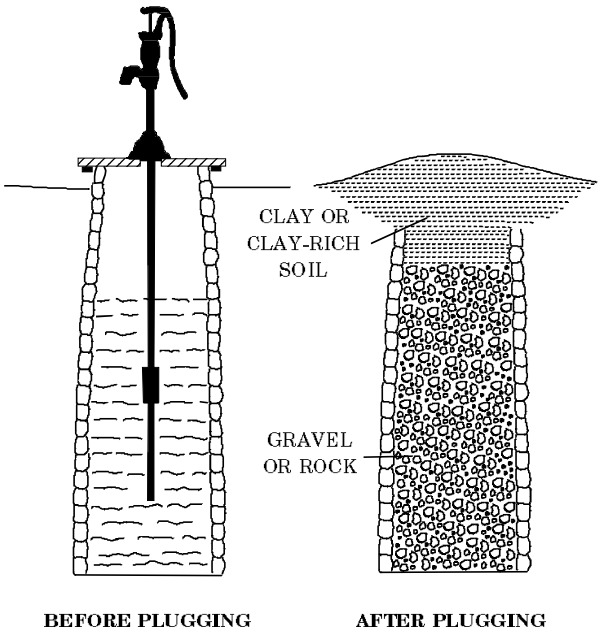
DUG WELLS AND CISTERNS

Dug wells commonly are three to six feet in diameter, often larger at the bottom than at the top, and may be from ten feet to more than 30 feet deep. Usually they are lined with brick or field stone, and typically produce less than three gallons of water per minute. Because of their large volume, they can store several thousand gallons of water, enough to meet household and livestock demands.

Cisterns are generally used for private water supply in areas where groundwater resources are poor, or too expensive to develop. Modern cisterns are usually concrete or fiberglass tanks buried in the ground, but older cisterns were dug and constructed by hand. These commonly were three to six feet in diameter, 15 to 30 feet deep, and lined with stone, brick, or concrete. The top of the cistern was capped with a concrete slab or wooden cover.

Dug wells and cisterns are most common in northern and western Missouri but may be found in any part of the state. They were once an important source of water but today most are abandoned, and have become silent traps that can easily ensnare small children and even adults. **Potential tragedies can be avoided simply by plugging abandoned dug wells and cisterns.**

Dug wells and cisterns still in service should have a sturdy cover, preferably made of reinforced concrete. The covers should be securely fastened, or be heavy enough to keep curious children from removing them. Abandoned dug wells and cisterns can be plugged by pushing in the upper few feet of well lining, and filling the well to within three feet of the surface with chlorinated clean fill such as course gravel or rock, varied sized agricultural lime, or sand. The remainder of the well should be filled with clay or clay-rich soil. Soil should be mounded slightly at the top and compacted to help offset settling. If a dug well is quite shallow, it can be pumped out and destroyed with a bulldozer.



Large diameter wells and cisterns can be plugged by filling the well to within two feet of the surface with chlorinated clean fill, and the upper portion of the well with compacted clay or clay-rich soil.

BORED WELLS

Bored wells are constructed with an auger, scoop, dragline, or some similar machine. They are the modern equivalent of the old, hand-dug wells. These wells are relatively large-diameter, usually two to four feet, and may be 20 to 80 feet deep. Older bored wells are commonly lined with sections of clay pipe; newer bored wells are usually lined with concrete pipe. If properly constructed and covered, they can provide a satisfactory water supply and present no special hazard. Abandoned, they are as dangerous as dug wells and cisterns, and should be plugged.

Bored wells can be plugged using the same methods as those described for dug wells and cisterns. As with dug wells and cisterns, plugging bored wells is easier and more effective if as much water as possible is pumped from the well before it is filled.

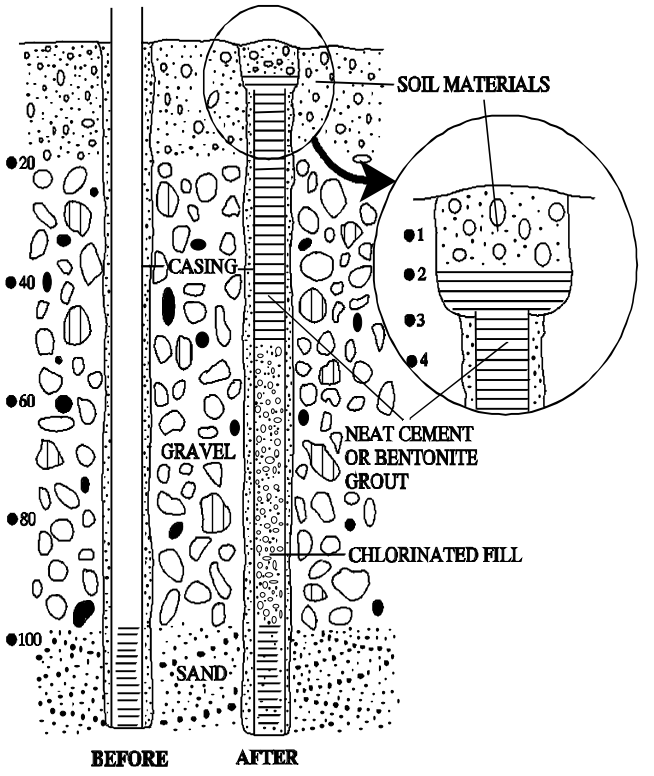
DRILLED WELLS

Abandoned drilled wells, though not commonly considered to be a safety hazard, do present an avenue or conduit for contaminants to enter the groundwater system. If the diameter of the casing is large enough, very small children or small animals can fall into them. Drilled wells fall into two categories: wells drilled into unconsolidated material such as glacial drift, or sand and gravel (alluvial) deposits along major streams, and wells drilled into consolidated bedrock such as limestone, sandstone, and dolomite.

The best way to plug either type of well is to remove the pump or any debris in the well, cut the casing off three feet below the surface, and fill the well from bottom to top with neat-cement or bentonite grout, or chipped bentonite. Neat-cement grout is mixed at the ratio of no more than six gallons of water per 94-pound bag of cement. Bentonite grout is a bentonite-water slurry that contains at least 20 percent solids. Neat-cement or bentonite grout must not be poured from the surface through standing water; it must be inserted through a grout pipe placed into the well near the bottom. This fills the well, bottom to top, and the water in the well is displaced upward as the grout is pumped. Chipped bentonite is a solid bentonite that is designed to fall through water and swell into many times its size. It is recommended that a permitted driller or pump installer be contracted to plug wells in this manner.

Private water supply wells drilled in unconsolidated material are usually not more than six inches in diameter, and may be from 40 to 150 feet deep. The lower portion of the well contains slotted pipe called a well screen, which allows water to enter the well. The remainder of the hole contains casing. To plug these wells, remove the pump or any debris. Dig around the casing to three feet in depth and cut the casing off. Fill the well with chlorinated clean fill as used in hand-dug wells to a point 50 feet from the surface. Place a grout plug that fills the upper 50 feet of casing and extends into the larger excavated area at least one foot. (See diagram at right.)

PLUGGING DOMESTIC WELLS IN UNCONSOLIDATED DEPOSITS



Private water supply wells drilled in bedrock are usually six inches in diameter, and may range in depth from 40 feet to more than 500 feet. The amount of well casing (steel, wrought iron, or thermoplastic pipe used to seal out surface material and shallow groundwater) depends on the location and age of the well. If the owner has information concerning well depth, the amount of casing, and depth to water, the landowner may proceed as stated. Remove the pump and any debris from the well. Dig around the casing to a depth of three feet and cut off

the casing. Fill the well with chlorinated clean fill such as gravel or varied-sized agricultural lime from the bottom of the well to 50 feet below the base of the casing. Place a grout plug from this point filling the hole and casing to a point two feet from the surface. (See diagram below.)

The clean fill used in filling the lower part of the abandoned well should be chlorinated to prevent bacteria from being introduced into aquifers. This can be accomplished by simply pouring ordinary household bleach into the well before the aggregate is added, or by adding sodium hypochlorite tablets to the gravel as it is being introduced into the well. These tablets can be purchased at outlets having swimming pool supplies.

REGISTRATION

Missouri requires the plugging of abandoned wells to be registered. This is accomplished by plugging the wells according to the rules set out in 10 CSR 23-3.110 (this brochure summarizes these rules) and by filling out a registration record and submitting it to the Missouri Department of Natural Resourcesí Geological Survey and Resource Assessment Division (GSRAD), with the proper fee. Currently, the registration fee has been eliminated to encourage the proper plugging of abandoned wells.

Once the registration record has been submitted, it will be reviewed by the division. Upon successful review, a registration number will be sent to the property owner which documents that the well has been plugged according to the minimum standards. The registration record and number are important to keep in your records because lending institutions and/or local governmental bodies may require proof of proper plugging upon sale or refinancing of the property.

SUMMARY

Plugging abandoned wells is the responsibility of the land owner. An abandoned drilled well can introduce contaminants into the groundwater system, and may be responsible for contaminating your water supply, or that of your neighbors. It is far less expensive to properly plug an abandoned well than to pay the costs of cleaning up an aquifer. Costs should not be a consideration with abandoned bored wells, dug wells, cisterns, or any well that is large enough for a person to fall into because no amount of money can compensate for the loss of human life.

Landowners can plug their own wells used for domestic purposes if they follow the rules summarized in this brochure. The landowner must know the total depth, length of casing and depth to water to proceed in plugging their well. If the landowner does not know and cannot find out the details of how the well was constructed, he may contact the Geological Survey and Resource Assessment Division for assistance, or he may use a Missouri-permitted well installation or pump installation contractor to measure or plug the abandoned well. The one exception concerns hand-dug wells. Contractors hired to plug hand-dug wells or cisterns do not have to be permitted but the landowner is responsible to see that the well is plugged according to the rules and reported as required.

For additional information or technical advice on plugging wells, please contact the Missouri Department of Natural Resources, Geological Survey and Resource Assessment Division, P.O. Box 250, Rolla, MO 65402-0250, or call (573) 368-2165.